

WHAT IS CLAIMED IS:

1. In a maskless lithography system having a spatial light modulator (SLM), a method of producing grayscale on an object, said method comprising:
  - exposing the object with light to produce a pattern; and
  - modulating an exposure time of the object to produce a range of grayscale levels on the object.
2. The method of claim 1, wherein said modulating step comprises varying the pulse width of a laser light source.
3. The method of claim 2, wherein the pattern is produced by the laser operating at a first pulse width, the method further comprising:
  - overlapping the pattern with a laser operating at a second pulse width to produce an overlapping exposure, wherein the second pulse width is different from the first pulse width,
  - such that the overlapping exposure creates a different range of grayscale levels on the object.
4. The method of claim 3, wherein said overlapping step is repeated until a desired number of grayscale levels is achieved.
5. The method of claim 1, wherein the SLM has a plurality of pixels, the method further comprising before said exposing step:
  - switching the plurality of pixels between active states or from one active state to an OFF state, wherein an active state of a pixel corresponds to transmitting light to said object by that pixel at a particular gray level, and the OFF state corresponds to transmitting no light to said object by that pixel.
6. The method of claim 5, wherein said modulating step comprises:

switching a portion of the plurality of pixels of the SLM to alternate states earlier than other pixels in the SLM.

7. The method of claim 6, further comprising compensating for smearing of the pattern.

8. In a maskless lithography system having a spatial light modulator (SLM), a method of producing gray-scale on an object, said method comprising:

    exposing the object with a light beam to produce a pattern; and  
    modulating the power of the light beam to produce a range of grayscale levels on the object.

9. The method of claim 8, wherein the pattern is produced by a light beam having a first power, the method further comprising:

    overlapping the pattern with a light beam having a second power to produce an overlapping exposure,

    such that the overlapping exposure creates a different range of grayscale levels on the object.

10. The method of claim 9, wherein said overlapping step is repeated until a desired number of grayscale levels is achieved.

11. The method of claim 10, wherein said overlapping step comprises:

    passing the light beam through a filter with a constant intensity transmission value that is specific for the overlapping exposure; and  
    transmitting said light beam to the object.

12. The method of claim 9, wherein said overlapping step comprises:

    splitting the light beam into more than one beam;

passing each beam through a filter with a constant intensity transmission value;

transmitting each beam using its own individual SLM; and

overlapping the images from each individual SLM on the object.

13. A maskless lithography system comprising:

an illumination source;

an object; and

a controller,

wherein the controller modulates the duration of time in which a light beam from the light source exposes the object to produce a range of grayscale levels on the object.

14. The maskless lithography system of claim 13, wherein said modulator varies the duration of time by varying the pulse width of a laser light source between successive exposures.

15. The maskless lithography system of claim 13, further comprising between the illumination source and the object:

a spatial light modulator (SLM),

wherein the SLM has a plurality of pixels, and

wherein an active state of a pixel corresponds to transmitting light to said object by that pixel at a particular gray level, and an OFF state corresponds to transmitting no light to said object by that pixel.

16. The maskless lithography system of 15, wherein said modulator varies the duration of time by switching at least one of the pixels in the SLM to at least one alternate state earlier than other pixels in the SLM.

17. A maskless lithography system comprising:

an illumination source that outputs a light beam;

a beamsplitter, that splits the light beam into a plurality of beams;  
a plurality of filters, each filter corresponding to one of the plurality of beams and having a constant intensity transmission value; and  
a plurality of spatial light modulators (SLMs), each SLM corresponding to one of the plurality of beams,  
wherein each one of the plurality of beams passes through the corresponding filter and illuminates the corresponding SLM array, so that patterns produced by the plurality of SLMs are overlapped on the object.

18. The system of claim 17, further comprising:

a control system for controlling each pattern generated by each of the plurality of SLMs.

19. In a maskless lithography system having a spatial light modulator (SLM) with a plurality of pixels, a method of producing grayscale on an object, said method comprising:

exposing the object with a light beam to produce a pattern;

modulating an exposure time of the object to produce a first range of grayscale levels on the object; and

modulating the power of the light beam to produce a second range of grayscale levels on the object.

20. The method of claim 19, wherein modulating an exposure time of the object comprises at least one of the group consisting of:

varying the pulse width of the light beam between exposures to produce overlapping exposures; and

switching a portion of the plurality of pixels of the SLM to alternate states earlier than other pixels in the SLM.

21. The method of claim 19, wherein modulating the power of the light beam comprises at least one of the group consisting of:

varying the power of the light beam between exposures to produce overlapping exposures;

changing an intensity transmission value of a filter through which the light beam passes to produce overlapping exposures; and

after splitting the light beam into a plurality of light beams, passing each beam through its own filter with a constant intensity transmission value.